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December 12: "Mathematics in colonial times" by Leona Dickrager '22; "Alice in the Wonderland of mathematics" by Nina Grace Smith '23; "Numerical curiosities" by Philip Campbell '22.

January 16, 1922: "Cardan's solution of the cubic" by Professor Lindeman.

February 13: "Life and works of Descartes" by Ruth King '22; "Life and works of Newton" by Nellie Balliet '22.

March 13: "Projective geometry" by Professor Gold.

The number of members each year has been about 40; and the average attendance about 25. In the fall and in the spring also there is a social party.

(Report by Miss Kimble.)

THE MATHEMATICS CLUB OF GOUCHER COLLEGE, Baltimore, Md.

[*1918*, 357; *1919*, 365; *1921*, 274; *1922*, 26.]

Meetings during the second half of 1920–21 were held as follows:

March 3: "Human calculating prodigies" by Grace McCaulley '23; "The theory of Amsler's planimeter" by Katherine Wisner '21.

April 7: "A new theorem concerning three circles" by Henrietta Morris '23; "Proof that an angle cannot be trisected by ruler and compass" by Eva Lazarus '22.

April 24: "History of the theory of numbers, with illustrative problems" by Dorothy Biscoe '22; "The fallacy in a recently proposed method of trisecting an angle by ruler and compass" by Mildred Brown '21; "Rules for checking addition, with proofs" by Mildred Trueheart '22.

The annual picnic of the Club took place in May, and was attended by many of its alumnæ members.

(Reported by Professor Lewis.)

THE MATHEMATICS CLUB OF VASSAR COLLEGE, Poughkeepsie, N. Y.

[*1918*, 136, 456; *1919*, 264; *1920*, 78, 427.]

October 21, 1920: A tea was given, to which were invited all who were eligible to membership. The following officers were elected for the first semester: President, Mary West '21; vice-president, Theresa McMakin '22; secretary-treasurer, Alta Teeple '22; executive committee, Professor Elizabeth B. Cowley, Elizabeth Larsen '21.

November 16: "Women in mathematics" by Elinor Hollis '21.

December 9: "History, development, and use of logarithms" by Grace Fenstermaker '21, Mathematical tricks were exhibited by Elsie Stuart '22.

February 24, 1921: The following officers were elected: President, Amy Davison '21; vice-president, Theresa McMakin '22; secretary-treasurer, Alta Teeple '22; executive committee, Professor Cowley, Elizabeth Larsen '21.

March 17: "The Einstein theory" by Elizabeth Larsen '21.

April 28: "Codes and ciphers" by Dorothy Laws '22; "The fourth dimension" by Edith Morrison '22.

May 19: A picnic supper. Charades were played with such words as hypothenuse, perpendicular, and algebra.

(Reported by Miss Teeple.)

PROBLEMS AND SOLUTIONS.

EDITED BY B. F. FINKEL, OTTO DUNKEL, AND H. P. MANNING.

Send all communications about Problems and Solutions to B. F. FINKEL, Springfield, Mo.

PROBLEMS FOR SOLUTION.

[N.B. Problems containing results believed to be new, or extensions of old results, are especially sought. The editorial work would be greatly facilitated if, on sending in problems, proposers would also enclose any solutions or information that will assist the editors in checking the statements. In general, problems in well-known text-books, or results found in readily accessible sources will not be proposed as problems for solution in the MONTHLY. In so far as possible, however, the editors will be glad to assist members of the Association with their difficulties in the solution of such problems.]

2966. Proposed by OTTO DUNKEL, Washington University.

When a curve produces a caustic by the reflection of the rays proceeding from a fixed point, δ and δ' the lengths of the incident and reflected rays, R the radius of curvature of the curve, and ω the angle of incidence, satisfy the equation (see *1920*, 225)

$$\frac{1}{\delta} + \frac{1}{\delta'} = \frac{2}{R \cos \omega}.$$

Give a geometrical proof of this relation using the harmonic properties of the figure and obtain in this manner a simpler and different geometrical derivation from that given in Humbert's *Cours d'Analyse*, volume 1, page 77.

2967. Proposed by ELIJAH SWIFT, University of Vermont.

A plane revolves about one of two non-coplanar lines as an axis. Find the locus, *in the plane*, of the intersection of the plane and the other line.

2968. Proposed by MALCOLM FOSTER, Yale University.

A curve C is the directrix of a ruled surface, and g is any ruling. Relative to the trihedral of C at the point of intersection with g, the direction-cosines of g are α, β, γ, expressed as functions of the arc of C. Prove that the distance t along g from C to the line of striction is given by

$$t = \frac{\frac{\beta}{\rho} - \alpha'}{\Sigma\alpha'^2 + \frac{2}{\rho}(\alpha\beta' - \alpha'\beta) + \frac{2}{\tau}(\beta'\gamma - \beta\gamma') + \frac{1}{\rho^2}(1 - \gamma^2) + \frac{1}{\tau^2}(1 - \alpha^2) + \frac{2}{\rho\tau}\alpha\gamma},$$

where ρ and τ are the radii of first and second curvature of C.

2969. Proposed by J. N. VEDDER, Union College, Schenectady, N. Y.

The following integral equations arise in connection with electrical theory:

$$f(x) = c - \lambda\int_{-a}^{+a} \log\left|\frac{a - u}{x - u}\right| f(u)du \tag{1}$$

and

$$f(x, y) = c - \lambda\int_{-a}^{+a}\int_{-b}^{+b} \log\sqrt{\frac{(a - u)^2 + (b - v)^2}{(x - u)^2 + (y - v)^2}} f(u, v)du\, dv. \tag{2}$$

The value of $\int_{-a}^{+a} f(x)dx$ is required from (1) and $\int_{-a}^{+a}\int_{-b}^{+b} f(x, y)dxdy$ from (2) in a form adapted to arithmetical calculation. In each case c is a given constant.

2970. Proposed by E. T. BELL, University of Washington.

For what values of the positive rational integers a, b, c, d, e, f are $a \cos^b (2\pi/c)$, $d \sin^e (2\pi/f)$ quadratic integers?

2971. Proposed by C. E. HORNE, The University of Porto Rico, Mayaguez, P. R.

Prove that the two tangents drawn to an ellipse from any external point subtend equal angles at a focus. (This problem is found in some text-books, but the Proposer is anxious to see an analytic solution of it.)

SOLUTIONS.

2828 [1920, 186]. Proposed by T. M. BLAKSLEE, Ames, Iowa.

On page 72 of R. B. Hayward's "*The Algebra of Coplanar Vectors and Trigonometry*" occurs the sentence: "It will be a good exercise for the student to show that cos (90°/7) = $\frac{1}{2}\sqrt{x_1}$ where x_1 is the greatest root of the equation

$$x^3 - 7x^2 + 14x - 7 = 0.$$